lec 5 dr mervat

Corelation :-

The relation between observation

$$\text{Corelation} = \frac{\sigma_{xy}}{\sigma_x \cdot \sigma_y} = \frac{\text{Covariance}}{Var(x) \cdot Var(y)}$$

How to get standered deviation

1. $\text{mean} = \dfrac{\sum \text{observation}}{\text{number}}$

2. Residual = mean - observation

$$\sigma_s = \sqrt{\frac{\sum VV}{n-1}}$$

→ st. deviation for a single observation

$$\text{st. dev of mean} = \frac{\sigma_s}{\sqrt{n}}$$

Variance Covarience Matrix

$$\begin{bmatrix} \sigma_x^2 & Cov_{xy} & Cov_{xz} \\ Cov_{yx} & \sigma_y^2 & Cov_{yz} \\ Cov_{zx} & Cov_{zy} & \sigma_z^2 \end{bmatrix}$$

diagonal willnot contain any negative sign

Corelation :-

$0 < e < .35$ weak

$.35 < e < .75$ medium

$.75 < e < 1$ " strong

$e = 1 \longrightarrow$ in the Corelation between the Variable and itself

$$e = \frac{\sigma_{xx}}{\sigma_x \sigma_x} = 1$$

Example :- find The Corellation between the weight and the height

weight	170	155	190	140	145	165	185	180	155	175
height	70	70	70	66	68	72	70	73	60	70

solution

weight	Resedual	V_w^2	height	Resedual	V_H^2	$V_w V_H$
170	-4	10	70	0	0	0
155	11	121	70	0	0	0
190	-24	576	70		4	48
140	26	676	66		16	104
145	21	441	68			42
165	1	1	72			-2
185	-19		70			0
180	-14		73			42
155	11		60			11
175	-9		70			2
$\Sigma 1660$		$\Sigma 2592$	$\Sigma 700$			$\Sigma 245$

mean of weight $m_w = \frac{1660}{10} = 166$

~ ~ height $m_h \rightarrow \frac{700}{10} = 70$

$$\sigma_w = \sqrt{\frac{\Sigma V V_w}{n-1}} = \sqrt{\frac{2592}{9}} = 16.97$$

$$\sigma_H = \sqrt{\frac{\Sigma V V_h}{n-1}} = \sqrt{\frac{-}{9}} = 2.05$$

$$\text{Covariance} = \frac{\Sigma V_w V_H}{n-1} = \frac{245}{9} = 27.22$$

$$\text{Corelation} = \frac{27.22}{16.97(2.05)} = .78 \quad \text{strong}$$

st. dev of mean $\sigma_{H\,m} = \frac{16.97}{\sqrt{10}} = 5.34$

$$\sigma_{Vm} = \frac{2.05}{\sqrt{10}} = 0.65$$

last result will be like this

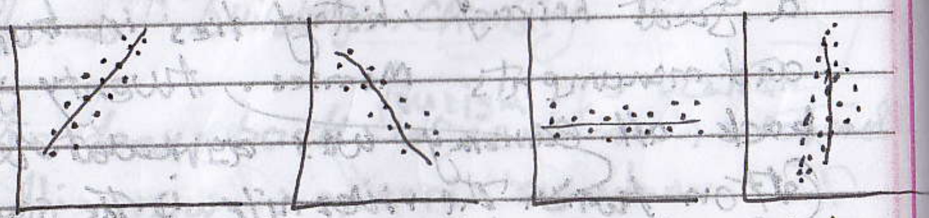
for weight $\rightarrow$ 166 $\pm$ 5.34

for Height $\rightarrow$ 70 $\pm$ 0.65

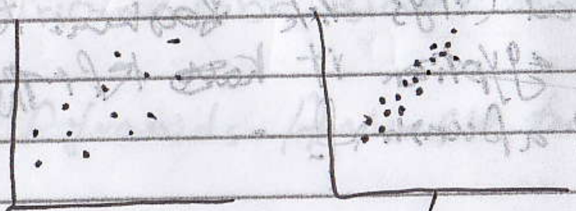
Corelation is between two dependant variables expressed by coefficient of Corelation
The Corelation Could be Positive or negative

ρ changes from $+1 : -1$

Scatter Plot



Positive Negative no Corelation



weak Corelation strong Corelation

Theory of error "lec 5"

1- standered deviation $\sigma = \sqrt{\frac{\sum v^2}{n-1}}$ → Resedual

2- Variance $= \frac{\sum v^2}{n-1}$

↳ we take n times but not The right Value

3- Covariance $= \frac{\sum v_x v_y}{n-1}$

4- e 5 $\rho = \frac{\sigma v_{xy}}{\sigma_x \cdot \sigma_y}$

5- Corelation is mostly 1 between the Variabe and itself

6- Variance Covariance matrix

$$\begin{bmatrix} \sigma_x^2 & Cov & Cov \\ - & \sigma_y^2 & - \\ - & - & \sigma_z^2 \end{bmatrix}$$

7- less standered deviation gives you high accuracy

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if you get some measurments you could get the mean of them

* The expected value is The accurate one

How to get st dev for an expected value

- Here you calculate e ⟶ expected error

$$\text{st. deviation } \sqrt{\frac{\Sigma[e \cdot e]}{n}}$$

$\Sigma[e \cdot e]$ ⟶ we dont need sign

n ⟶ The Right Value between those measur...

X.	Δx	Δx^2	V	V^2
153° 23' 37.6	0.6	0.36	-0.04	
— — 30.9	-0.1	0.01	0.66	
31.6	0.6	—	0.861	
31.3	0.3	—	-0.024	
31.8	0.8	—	-0.24	
31.8	0.8	—	-0.24	
31.7	0.7	—	-0.140	
31.8	0.8	—	-0.24	
31.6	0	—	+0.56	
32.1	1.1	—	-0.54	
	5.6	4.44		1.340

and you've recieved an aproximate value for x

$X^0 = 153° 23' 3''$ ⟶ it's not better than expectd or mean

$\overline{\Delta X}$: try to make Δx close to mean

$$\overline{\Delta X} = \frac{5.6}{10} = 0.56'$$

n ⟵ 10

* and know to get Resedual - the distance from the mean

$v = \bar{X} - \Delta x$

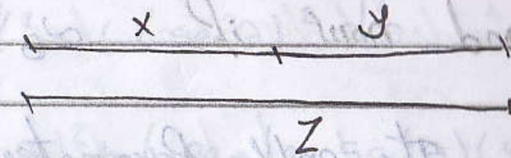
* now we've got v^2 you could get the st. deviation $\sigma = \sqrt{\frac{\sum v^2}{n-1}}$ ↳ of approximation

* $[vv] = [\Delta x^2] - \frac{[\Delta x]^2}{n}$

* and now to get st. dev of mean

$\bar{x} = 153\ 23'\ 3''$

(1) math model

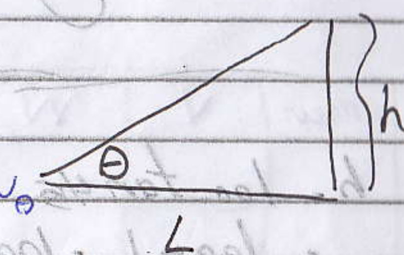


if you've measured x & y and calculated σ_x & σ_y

How to get σ_Z $\quad Z = x + y$

$\sigma_Z^2 = \sigma_x^2 + \sigma_y^2$ "linear math model"

$h = L \tan\theta$



you could get σ_L & σ_θ

but How about σ_h you first've to mak linearization

1- diffrantiation
2- logharithmatic